

## REMARKS

The office action of January 4, 2007 has been reviewed and its contents carefully noted. Reconsideration of this case, as amended, is respectfully requested. Claims 1-5, 7 and 9-13 remain in this case, claim 6 being cancelled by this response.

Before commenting in detail on the rejections, the undersigned wishes to express his appreciation to the Examiner for the unscheduled telephonic interview of March 18, 2007. The undersigned realizes that his call was not scheduled but the Examiner kindly took the time to consider his comments, discuss them with her SPE and then call back to further discuss this application. No agreement was reached during these conversations but some of the guidance given by the Examiner has been incorporated into the Amendments hereinbelow.

### Claim Rejections - 35 USC § 103

Claims 1-5 and 9-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kosco (U.S. Pat. No. 6,338,747) in view of the ASM Handbook (Vol. 7) or Graham (1998).

Kosco discloses a method for producing a powder metallurgical material suitable for manufacturing gears or sprockets (col. 1 lines 1-30). However, Kosco does not recite machining or grinding the compact to produce a profile with *detailed surface geometry without substantial densification*. The Examiner adds the disclosure of the ASM Handbook (Vol. 7) and Graham (presumably, the Examiner meant Causton, et al., since these are the authors of the article, "Machinability of P/M Steels", received with the Office Action) which teaches that through holes may be drilled through a powder metal part following pre-sintering but prior to sinter hardening the part.

Applicants respectfully traverse this rejection for the following reasons. First, the Examiner states, at the top of page 4 of the Office Action, that the "range of 2000 to 2400° F for

≥ 20 minutes is *close enough* to the claimed range of 1650°F for 30 minutes...” Applicants respectfully assert, with respect to the temperature range vs. time that one skilled in the art of powder metal processing would realize that different temperature vs. time operations will produce finished parts having different functional, density and hardness characteristics.

As correctly recognized by the Examiner, Kosco does not disclose machining a P/M part to produce a geometric profile. In Kosco, a metallurgic powder is compacted at a pressure between 20 to 70 tsi, heated to 2000°F to 2400°F for 15 to 120 minutes, and then cooled at a rate no greater than 60°F per minute to room temperature, to ensure that the compact may be sufficiently mechanically worked. Then, the compact is deliberately deformed to increase the density. After the densification step, the compact is heated again to 2050°F-2400°F and cooled at a rate of 160°F - 400°F/min to room temperature. A secondary operation of tempering may follow. The densification in Kosco increases the surface density of a portion of the part by mechanical working.

Referring to Applicants’ claim 1, step d) refers to "cooling the compact at a rate of 10°F to 120°F to ambient temperature". This is not related to hot forming the compact. The example is specific to densification. Applicants’ claim 1 states "without substantial densification" (emphasis added). It is respectfully submitted that from Kosco’s Example 2, as well as the complete disclosure of this patent that Kosco teaches away from Applicants’ invention.

With respect to the article, the “Machinability of P/M Steels”, it focuses on drilling through holes into the part. It is respectfully submitted that this process is not the same as forming a geometric shape, such as an undercut between two rows on teeth *on the surface* of a powder metal part. Further, on page 675, under the heading “Grinding”, the authors note that should grinding be “necessary”, it is only for the purpose of achieving “dimensional functionality” of the part. The amount of material removed (from about .003 to .0005 inch) is quite small and is therefore distinguishable from Applicants’ claimed process of removing a much greater amount of material for the purpose of forming geometric features.

Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kosco (U.S. Pat. No. 6,338,747) in view of the ASM Handbook (Vol. 7) as applied to claim 1. Further, claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kosco (U.S. Pat. No.

6,338,747) in view of Graham (1998) as applied to claim 1, and further in view of Graupner et al. (U.S. Pat. No. 6,134,786). Additionally, claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kosco (U.S. Pat. No. 6,338,747) in view of Graham (1998) as applied to claim 1, and further in view of Graupner et al. (U.S. Pat. No. 6,134,786) and the ASM Handbook.

Kosco is silent to grinding as a working step. It is respectfully submitted that Graupner et al. do not teach or provide what Kosco lacks. Graupner et al. disclose a method to "overcome the limitations of misalignment between gear teeth and, misalignment between gear teeth and the gear centerline, or lead line error, ...avoids the requirement for honing and undercutting the root area between adjacent gear teeth... the gears are regenerated by skiving the gear **after** heat treatment to realign the gear teeth with each other and the gear centerline, to overcome misalignment and lead line error (emphasis added)" (col. 3, lines 8-18). "This process serves to skive or remove extremely thin layers of material on the involute surfaces of gear teeth to thereby regenerate tooth surfaces" (col. 5-6, lines 60-3). The small amount of material removed from the gear teeth is 0.005 to 0.007 inches and the material is removed without contacting the root or undercutting the root of the gear teeth (col. 6, lines 13-18). The amount of material removed is similar to the amount of material removed as taught in the disclosure "Machinability of P/M Steels" in which this amount is described as being "necessary to achieve *dimensional* functionality..."(emphasis added).

In col. 5, lines 2-6, Graupner et al. state that, "[d]uring the manufacture of gears, it is known that gear teeth can become misaligned relative to each other and to center line of gear. Therefore, gears are frequently regenerated on grinding machines after heat treating to regenerate gear teeth relationships". Graupner et al. teach *regenerating gear teeth* to correct the relationship between gear teeth and does not say anything about producing a geometric profile of a groove between two rows of teeth. Referring to enclosed exhibit B (submitted previously, but provided herein again for the convenience of the Examiner), a comparison between the grinding used in Applicants' invention versus the grinding used in Graupner et al. is shown. Applicants start off with a cross-section of a sprocket that only has a whole row of teeth as shown in Exhibit C (also submitted again for the convenience of the Examiner). Profile or form grinding produces detailed geometric shapes, such as multiple rows of teeth, an undercut, and other complex forms are produced. Applicants remove a significantly greater amount of material than is done by the

prior art, including Graupner et al. as shown in Exhibits B and C. Graupner et al. start with teeth already present and their profile is indicated by the solid line. After grinding has occurred, shown by the dashed line, only 0.005 to 0.007 inches on the involute surfaces of the gear teeth is removed. Furthermore, since grinding only occurs on the involute surfaces of the teeth, a profile with detailed surface geometry could not be formed as stated in the amended claim. The grinding in Graupner et al. corrects or reduces *misalignment between gear teeth*, adjacent gear teeth flanks and reduces lead line error of the gear. This reference does not "produce a profile of two rows of teeth with a groove in between the two rows" as claimed by Applicants. Moreover, heat treatment and hardening of the gear occur prior to skiving or regenerating the gear teeth in Graupner et al., while according to Applicants' method, machining or grinding the compact produces a profile of two rows of teeth with a groove in between the teeth prior to heat treatment and hardening as conducted in steps f and g. The combination of these references as applied against claim 6 would require that any machining of the *outside* of the part to create an *undercut* be performed *after* hardening. This is contrary to Applicants' claimed method. The Examiner will note that the subject matter of claim 6 has now been incorporated into claims 1 and 10 in order to fully distinguish the claimed invention from the cited art.

In addition, the independent claims 1 and 10 have been amended to point out that only the specific steps, in the specific sequence shown, are claimed by Applicants. Support for this amendment may be found in the process flow chart of Figure 1, the numerically identified sequencing of the steps as shown in the first paragraph of page 4 and in the Example, second full paragraph, where after each step, either the word "then" or "after" is used, indicating that the steps must be performed in that specific order.

#### Double Patenting Rejection

Claims 1-5 and 9-13 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1, 3, 8-11 and 24 of

copending Application No. 10/983,554 (U.S. PG Pub. 200510123432) in view of the ASM Handbook (Vol. 7) or Graham (1998).

Claims 6 and 7 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 1 of copending Application No. 10/983,554 (U.S. PG Pub. 2005/0123432) in view of the ASM Handbook as applied to instant claim 1.

Claim 6 is provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 1 of copending Application No. 10/983,554 (U.S. PG Pub. 2005/0123432) as applied to instant claim 1, and further in view of Graupner et al. (U.S. Pat. No. 6,134,786).

Claim 7 is provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1 and 9-11 of copending Application No. 10/983,554 (U.S. PG Pub. 2005/0123432) as applied to claim 1, and further in view of Graupner et al. (U.S. Pat. No. 6,134,786) and the ASM Handbook.

Accordingly, in compliance with 37 CFR 3.73(b), the undersigned Attorney of record has executed and timely files herewith a Terminal Disclaimer on behalf of the common owner of both this present application and pending patent application serial number 10/983,554. With the filing of this Terminal Disclaimer, since the co-pending application is the primary reference for each ground of rejection under this section of the Office Action, it is respectfully submitted that these rejections may now be withdrawn.

### **Conclusion**

Applicant believes the claims, as amended, are patentable over the prior art, and that this case is now in condition for allowance of all claims therein. Such action is thus respectfully requested. If the Examiner disagrees, or believes for any other reason that direct contact with Applicants' attorney would advance the prosecution of the case to finality, she is invited to telephone the undersigned at the number given below.

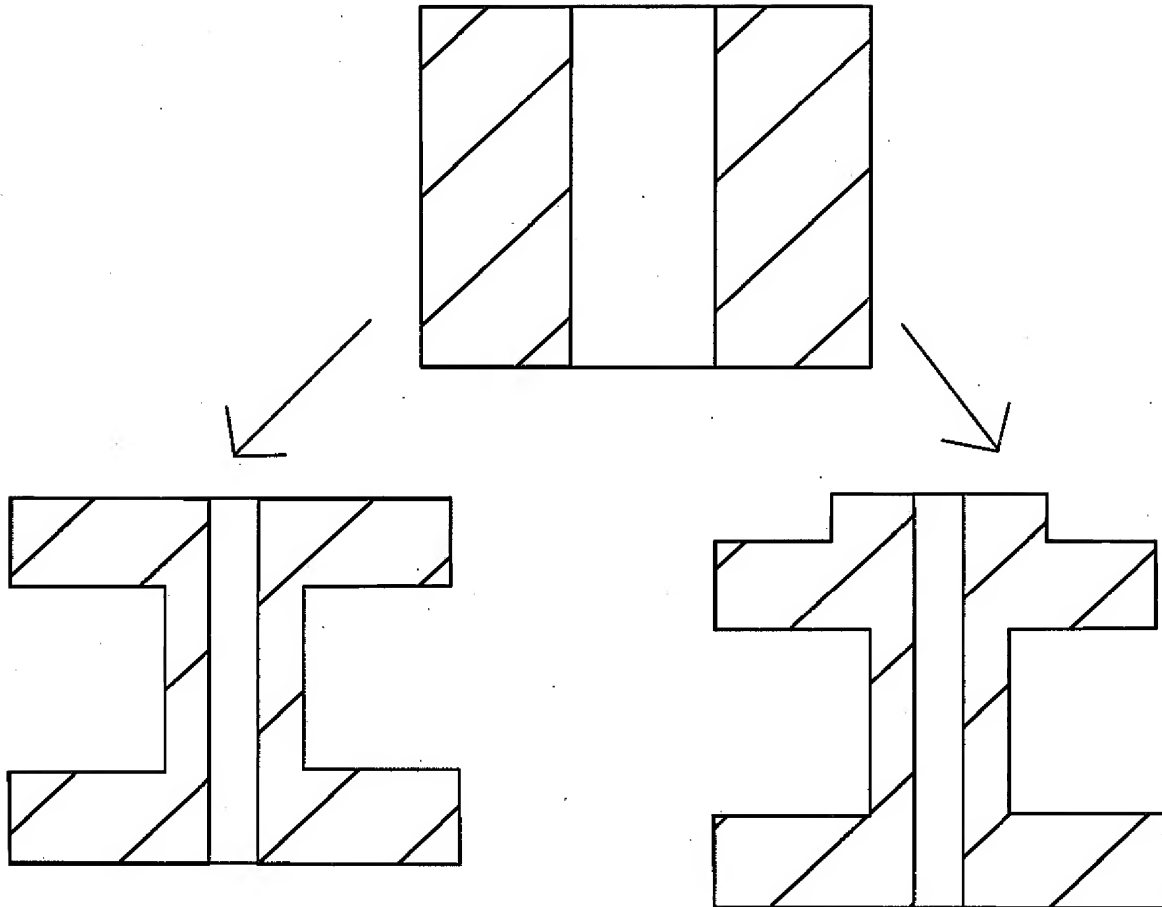
"Recognizing that Internet communications are not secured, I hereby authorize the PTO to communicate with me concerning any subject matter of this application by electronic mail. I understand that a copy of these communications will be made of record in the application file."

Respectfully Submitted:  
Kai Xu

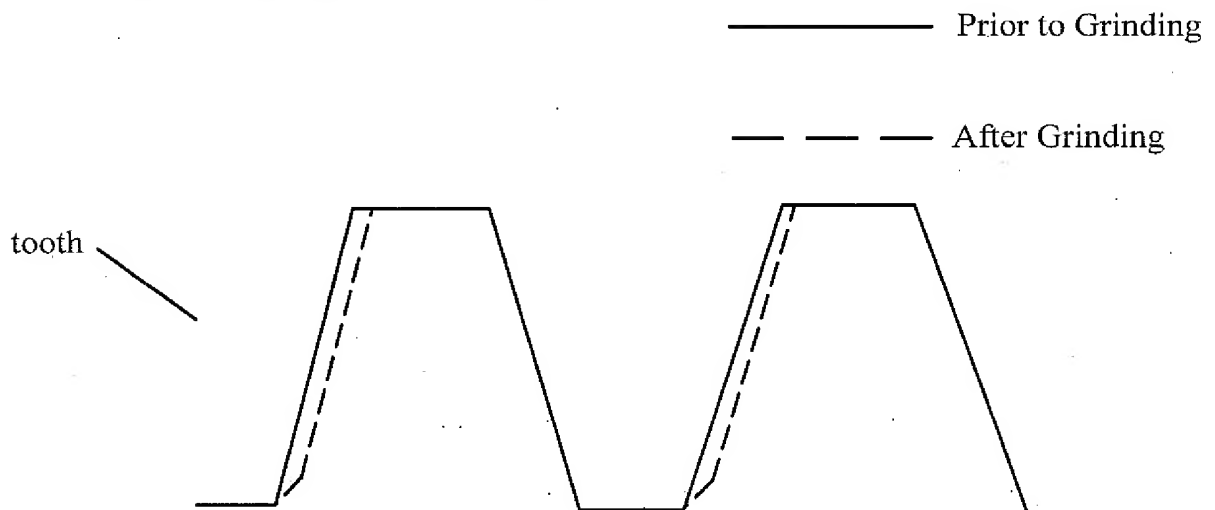
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## Exhibit B

### Applicant's Grinding



### Graupner et al. Grinding



## Exhibit C

### Applicant's Method

